Trubhuvan University

Bachelor of Science in Computer Science and Information Technology

Course Title: Computer Networks

Course No.:CSC 301   **Full Marks:** 60+20+20

Credit Hours: 3   **Pass Marks:** 24+8+8

Nature of Course: Discussion on types of networking techniques, internet, IPV4.

Goal: This course introduces concept of computer networking and discuss the different layers of networking model.

Corse Contents:

Unit 1:   **33 hrs**

1.1 Computer Network:
- Introduction to networking
- Computer networks and its uses
- Internet, evolution of internet and its application
- Advantages and disadvantages of computer networks
- Network edge: end system, clients, server, and their functions
- Connection oriented connectionless service
- Network core: circuit switching and packet switching, virtual circuit networks and datagram networks
- Network access: dialup modem, digital subscriber line (DSL) and physical media, ISP's hybrid fiber coaxial cable, wireless networks
- Physical media: guided and unguided media
    - Guided media:
        - Copper media: Twisted pair cable (UTP & STP), and Coaxial cable (Thicknet & Thinnet)
        - Optical fiber: Single mode and Multimode
    - Unguided media: Infrared, Radio wave, Microwave Repeater Stations, Satellites are used to regenerate the signal
- ISPs and Internet back bone

1.2 Protocol Layers:
- Introduction
- Layered architecture: need of layered model
- Introduction to OSI model and TCP/IP model
- The Internet protocol stack: Application, Transport, Network, Data link and Physical layer and corresponding protocols

- Data encapsulation steps: message, segment, packet, frame bits
- Addressing of different layers of TCP/IP: physical (link) address, logical (IP) address, port address
- Network entities and layers: Repeater, Hub, Bridge, Switch, Router

1.3 Application Layer:
- Introduction of application layer and its functions
- Principles of application layer protocols: application layer protocols, services needed to an application, services provided by transport layer protocols
- The web and HTTP: overview of HTTP, HTTP message formal, cookies
- File transfer: introduction, FTP commands & replies
- Domain name system(DNS): Introduction and importance of DNS, working of DNS, DNS records, DNS messages

1.4 Transport layer:
- Introduction to transport layer and its services
- Relationship between transport layer and network layer
- Transport layer in Internet: connection oriented and connectionless services
- Multiplexing and de-multiplexing
- Connectionless transport: UDP, UDP segment structure
- Reliable data transfer: building a reliable data transfer protocol, pipelined reliable data transfer protocols, Go back N (GBN), selective repeat (SR)
- Connection oriented transport: TCP, TCP connection, TCP segment structure, time estimation and timeout, flow control: sliding window
- Congestion control, approaches to congestion control and quality of service (choke packet, leaky bucket, token bucket)

1.5 Network Layer:
- Introduction
- Network service model: datagram and virtual circuit service
- Routing: definition, principles, static vs. dynamic routing, distance vector vs. link state routing algorithm, hierarchical routing: inter-AS routing & intra-AS routing
- The internet protocol (IP): IPv4 addressing, different classes of IPv4 addresses, private vs. public address, datagram format, IP datagram fragmentation
- Subnetting, subnet mask, introduction to CIDR
- Internet control message protocol (ICMP), packet format
- Network address translation (NAT): Introduction and need of NAT
- Routing in the Internet: Intra-AS routing in the Internet: RIP and OSPF, Intra-AS routing: BGP
- IPv6: need of IPv6, IPv6 addressing, IPv6 datagram format, advantages of IPv6, transition from Ipv4 to IPv6.
- Introduction to multicast routing

Unit 2:   **12Hrs.**

2.1 Link layer and local area networks: Introduction

- Data link layer: the services provided by the link layer
- Error detection and error correction techniques: parity checks, checksum, CRC
- Multiple access protocols:
    - Channelization: time division multiple access (TDMA), frequency division multiple access (FDMA), code division multiple access (CDMA)
    - Random access protocols: Introduction to ALOHA, Slotted ALOHA, CSMA, CSMA/CD, CSMA/CA
    - Controlled access: polling, token passing protocols
- Local area networks (LANs): Ethernet, token ring, FDDI
- LAN addresses and ARP: LAN address, address resolution protocol (ARP)
- Ethernet: frame structure, signal format, CSMA/CD, Ethernet technologies
- Wireless links: Introduction to IEEE 802.11 standards, IEEE 802.11b, Bluetooth
- Point to point protocol (PPP): introduction frame format
- Asynchronous Transfer Mode (ATM): characteristics, introduction to layers of ATM model (AAL, ATM layer, ATM physical layer)
- Introduction to frame relay

2.2 Multimedia Networking: Introduction, multimedia networking application, streaming audio and video

2.3 Network Management: Introduction, The infrastructure for network management

Laboratory works:

Developing the network system in a small scale which includes following tasks:

- Cabling
- Routing
- NAT
- Server/Client configuration for different application layer services

Recommended sequence:

Unit 1.1, 1.2, 2.1, 1.5, 1.4, 1.3, 2.2, 2.3

References:

1. "Computer Networking, A top down approach featuring the internet", James F. Kurose, Keith W. Ross
2. "Data communications and Networking", Behrouz A Forouzan
3. "Computer Networks", A. S. Tanenbaum

4. "Data and Computer Communications". William Stallings

Final Evaluation Format:

The final exam at the end of semester is conducted by TU, Institute of Science and Technology, Office of Dean, Kirtipur. The final evaluation contains 60% of the total evaluation having 3 hrs. exam duration. In final question all subunits of both units must be covered. And there are two sections: Long answer questions, and Short answer questions. The long answer questions section contains two questions having 10 marks in each from each unit. Students have to solve both questions. There may be one internal choice in only one question. While giving internal choice both questions must be from same unit. The short answer question section contains nine questions. Out of which students have to solve any eight questions only. Each question in this section contains five marks. One model question is provided.

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Institute of Science and Technology

Office of the Dean

Model Question

B.Sc. CSIT/Fifth Semester/Computer Network (CSC 301)

Full Marks: 60

Pass Marks: 24

Candidates are required to answer the questions in their own words as far as practicable.

Group A

Long Answer Questions (Attempt all questions) [10x2=20]

1. What are the benefits of layered network architecture? Compare OSI Reference model with TCP/IP Protocol suit.
   OR
   What is TCP? Show the header format of TCP segment and explain each field.
2. How does CRC work to detect the errors with multiple bits? A bit stream 10011101 is transmitted using a standard CRC method. The generator polynomial is x^3+1. Show the actual bit string transmitted. Suppose the third bit from the left is inverted during the transmission. Show how the error is detected at the receiver's end.
   Group B

Short answer Questions (Attempt any eight questions) [5x8=40]

3. What do you mean by data encapsulation? Explain.
4. What do you mean by a routing algorithm? How adaptive routing differs with non-adaptive routing?
5. List the fields of IPv4 header. What is the main function of time to live (TTL) field?
6. What do you mean by NAT? How does it work?
7. What is flow control? Explain sliding window algorithm for flow control?
8. What is DNS? Explain the importance of DNS in Internet.
9. Discuss briefly on ALOHA and slotted ALOHA protocols.
10. Explain the various applications of multimedia networking.
11. Describe the principle components of network management architecture with suitable diagram.